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Stationary tailgating in Gaborone, Botswana: the influence of gender, time of day, type of vehicle and presence of traffic officer

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ABSTRACT

This study investigated stationary tailgating in Gaborone, Botswana. We observed and measured the distance between 722 vehicles (541 male drivers, 181 female drivers) stopped at three traffic intersections in Gaborone during rush-hour and non-rush hour. Gender of driver, type of vehicle (private, commercial, government or company), whether it was rush-hour or not, whether or not a traffic officer was present and distance from the car in front, were recorded. Based on a benchmark of 350 centimetres, derived from the recommendation that cars maintain the distance of the length of a car from the vehicle in front of them when stopped, it was found that 76% of drivers tailgated. In general, men tailgated more than women and tailgating occurred more during rush-hour and when there was a traffic officer present. In addition, a series of four-way analysis of variance tests yielded a main effect for presence of officer, such that the average distance kept from the car in front was significantly less when a traffic officer was present than when a traffic officer was not present. The main effects of gender, time of day and vehicle type were not significant. Findings are discussed in relation to the impact on pedestrians as well as drivers and implications for traffic regulation procedures.

1. Introduction

In light of pleas from the Police Service, Department of Roads and Transport Safety and other traffic officials, road safety continues to be an issue of serious concern in Botswana. Statistics from the Botswana Police indicate that thousands of motor vehicle collisions (MVCs) are recorded annually [1]. In 2012, there were a total of 17,527 road traffic casualties, resulting in 404 fatalities and 1,285 serious injuries, in the country that has a population less than 2 million [1]. Despite a decrease in MVAs over the past 5 years, the number of fatalities has remained steady — although it spiked at 483 deaths in 2011 [1]. Not only do vehicle collisions take a toll on individuals in terms of loss of life, health and income, but the larger community and entire country are affected by the human and economic impact of MVAs [2]. Many of these collisions can be prevented. Amongst these preventable crashes are those that occur as a result of drivers not keeping a safe distance from each other. It is not unusual in Botswana to hear of vehicle collisions where one car lost control and hit another from the back, and for the other car to end up hitting the one in front, resulting in an accident that involves at least three vehicles, particularly on congested roadways and in poor weather conditions [3–5].

There is evidence that following too closely and not allowing sufficient stopping distance from the vehicle in front may pose crash and injury risk to motorists and pedestrians. Research underscores the danger of tailgating whilst in motion due to the risk of rear-end crashes and difficulty slowing down in time [6]. In Botswana, 2,365 of the 17,547 crashes in 2012 were caused by vehicles following too closely [1]. Moreover, **s**tationary tailgating, where vehicles are too close when stopped, is a risky driving behaviour that potentially negatively impacts pedestrians and motorists. Sudden movement forward may cause the pedestrians crossing in between to be hit by the car or sudden movement could make one vehicle hit the rear of a vehicle in front of it. Stationary tailgating highlights one of the problematic structural issues in many developing countries — that is the limited space that is shared between vehicles and pedestrians and the lack of appropriate physical boundaries separating the two road users [2]. Madzikigwa found that most crashes in urban Botswana involved a high occurrence of pedestrian accidents [5] due in part to drivers who engage in risky driving behaviours and do not obey road rules and the increase interaction between high speed motorised traffic and vulnerable road users such as pedestrians [2].

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1.1. Background

The problem of MVCs is not unique to Botswana. Road crashes are one of the leading causes of death worldwide [7] and account for the single largest cause of unintentional injury [8]. Each year, 1.2 million people die and 20 to 50 million are injured on the world's roadways [2]. Unfortunately, the burden of motor vehicle collisions disproportionately impacts developing countries [2,7,9].

Despite having less than 50% of the world's vehicles, low and middle income countries (LMICs) are where 90% of the world's road fatalities occur [2]. LMICs have the highest fatality rate per 100,000 population [2]. Further, pedestrians, children and individuals with lower socioeconomic status are at greatest risk for death and injury [10] in LMICs. World Health Organization figures indicate that road traffic injuries were the 9th leading cause of death in 2003 and are projected to move up to the 5th leading cause of death in 2030 [2]. In Botswana, road crashes are one of the top ten causes of death after illnesses such as HIV, heart disease, stroke, diabetes and tuberculosis [11]. Earlier statistics showed a trend of increasing MVCs in Botswana between 1982 and 2007 [2]. Whilst there has been a decrease in MVAs since 2008, the first half of 2013 saw another peak in accident rates, with more than 250 road traffic deaths documented [1].

Research shows that human error is a significant contributor to the vast majority of crashes [12,13]. In a study of drivers' actions over a 13-month period, high risk drivers (drivers who engage in behaviours that increase their risk of crashing) were 100 times more likely to be involved in crashes, near crashes or road incidents than non-high risk drivers [8]. Researchers have further specified distinctions between violations and errors as explanations for accidents. Violations are theorised to be influenced by social and motivational factors, whilst errors have been associated with mistakes due to information processing factors [12]. Both bear directly on rear-end crashes.

Recently, there has also emerged a body of literature that investigates other causal variables for MVAs besides human error. This line of investigation has led to some debate about the exact contribution of human errors and focuses instead on additional systemic (i.e., legislation, policies, etc.) and structural elements (roads, infrastructure, etc.) that are thought to impact crashes [14]. For instance, whilst the human errors research frequently examines psychological factors, it has also been criticised as individualistic for placing emphasis on human behaviour when other systemic factors may be at play [14]. From a systemic-focused perspective, human error is seen as a consequence of other systems failures, not just individuals' actions, and all road transport actors are responsible for road safety [14].

Roads in Gaborone, Botswana's capital, have become more crowded as people flock to the urban centre and economic development has allowed more people to purchase cars. Moreover, the ratio of cars to people in Botswana is one of the highest in Africa [15]. Recent figures estimate close to 300,000 registered vehicles in Botswana [2]. Botswana's 383% increase in traffic fatalities between 1976 and 1998 has been attributed to the increasing rate of motorization, amongst other causes [16]. As part of this automobile boom, numerous driving schools can be seen across the city helping learners to obtain their licences. However, it is important to investigate the question, what is the driving culture of Botswana?

1.1.1. Tailgating, rear-end crashes and pedestrians

One of the well-established contributors to rear-end crashes is tailgating or failing to keep a safe distance. Tailgating whilst in motion, also referred to as headway, is a form of aggressive driving which has been documented as central in rear-end accidents [17]. Even so, this kind of aggressive driving behaviour does not only take place when vehicles are in motion, but even when vehicles are stopped as evidenced by the fact that rear-end crushes do occur at intersections when vehicles begin to move.

Because of the limited headway when following a vehicle too closely, any change in the front vehicle's moving speed or the driver's actions could lead to an accident [18]. Additionally, in instances of tailgating the driver's perception and reaction time are factored into the ability to stop without hitting the vehicle in front. Research by Baldock and colleagues [19] found rear-end crashes were more likely to occur near cross-road intersections, during peak traffic hours and on straight roads. Furthermore, they found that the drivers in these accidents tended to be young, male and possess only a temporary drivers' licence [19]; hence, presumed to be less experienced. Research also indicates that drivers tend to inaccurately judge safe following distance [20,21].

In one study, drivers with prior accidents or violations, young drivers, male drivers, drivers with no passengers and drivers who did not wear a seat belt were found to maintain shorter headway distances whilst driving [22]. The same researchers found that newer and medium weight (as opposed to light or heavy) vehicles were associated with shorter headways [22]. These driver and vehicle characteristics are assumed to be linked with increased willingness to assume risk on the road; thus, maintaining shorter headway [22]. In another study, a sample of drivers who were surveyed identified heavy traffic as one of the top causes of tailgating [20].

The problem of short distance between standing vehicles – i.e., stationary tailgating – is also significant because it impacts pedestrians, one of the most vulnerable road user groups, who use the space to walk between cars when crossing. In many developing countries, pedestrian walking and crossing spaces are inadequate and they often do not have sufficient space, which presents a significant risk because there are few traffic calming measures to separate different road-user groups (i.e., pedestrians and drivers) [2]. Recent statistics underscore the risk that pedestrians encounter. In Botswana in 2012, 1,259 pedestrians were hit by vehicles and 105 were killed as a result of MVAs [1]. Police figures do not specify whether tailgating was the cause of any of these crashes; however, statistics indicate that the majority of the fatalities (81) occurred when pedestrians were crossing the road or walking on the side of the road. Furthermore 12 pedestrians were seriously injured secondary to rear-end crashes involving two or more vehicles [1].

Whilst it might be difficult to collect observational data on moving tailgating [18], investigating stationary distance between cars can be a valuable avenue to explore patterns in the distance that cars keep from one another and the risk that drivers take on the road. More importantly, stationary tailgating is a significant road safety concern in and of itself due to the potential risk to drivers and pedestrians.

Standards for specifying a safe distance between cars differ. A widely recommended following distance internationally is the 2–3 seconds rule for vehicles in motion [17]. Another official international recommendation from the New Jersey Motor Vehicle Commission [23] is that drivers should keep the distance of one car length for each 10 miles per hour of speed.

In Botswana, the Motor Vehicle Accident Fund, a major traffic stakeholder, has noted that tailgating – along with speed, weather conditions, alcohol use and lack of seatbelt use – is amongst the top five contributors to accident casualties in the country [24]. Police statistics bear this out as well. Over the past 5 years, rear-end crashes accounted for either the 1st or 2nd leading cause of collisions. There was an average of 4,278 rear-end crashes per year from 2008 to 2012. In 2012, 3,910 of the 14,371 collisions were rear-end crashes [1]. However, there is no documented regulation, policy or published standard on what distance following cars should keep from each other [25]. Even in speaking with licenced drivers in Gaborone, there are varying and conflicting answers that indicate lack of clarity amongst motorists.

1.1.2. Research rationale

As tailgating is documented as a significant contributor to car accidents – especially rear-end crashes – and there are several demographic predictors of tailgating, it is important to consider who tailgates